

# CA12CAxxBPxxIO - IO-Link



## Capacitive Proximity Sensors with IO-Link communication



### Benefits

- **A complete family.** Available in M12 in a robust PBT housing with an operation of 0.5-4 mm flush or 0.5-8 mm non-flush.
- **Enhanced EMC performance:** 4<sup>th</sup> Generation TRIPLESIELD™
- **Easy customization to specific OEM requests:** different cable lengths and materials, special labelling: customized pig-tail solutions with special cables and connectors are possible on request.
- **The output** can be operated either as a switching output or in IO-Link mode.
- **Fully configurable via output IO-Link v 1.1.** Electrical outputs can be configured as PNP / NPN / Push-Pull / External input, normally open or normally closed.
- **Timer functions** can be set, such as ON-delay, Off-delay, and one shot.
- **Logging functions:** Temperature, detecting counter, power cycle and operating hours.
- **Detection modes** Single point, two point and windows mode.
- **Analogue output:** In IO-Link mode the sensor will generate 16 bit analogue process data output representing the dielectric value measured by the sensor.

### Description

The new generation of CA12CA...IO sensors are a complete family of high performance capacitive sensors for detection of most solid or liquid targets in industrial applications such as Plastic & Rubber, Agriculture, Food & Beverage and Materials handling. The 4<sup>th</sup> Generation of TRIPLESIELD™ technology provides increased immunity to electromagnetic interference (EMI), especially to frequency drives, and improves immunity to humidity and dust.

On-board IO-Link communication opens up a variety of functions, such as easy communication and customization of advanced parameter settings.



### Applications

- Detection of glass in production of e.g., Solar panels, Mobile phones or Windows glass containing a tiny layer of metal coating.



### Main functions

- The sensor can be operated in IO-Link mode once connected to an IO-Link master or in standard I/O mode.

#### **Adjustable parameters via IO-Link interface:**

- Sensing distance and hysteresis.
- Sensing modes: single point or two point or window mode.
- Timer functions, e.g.: On-delay, Off delay, One shot leading edge or trailing edge.
- Logic functions such as: AND, OR, X-OR and SR-FF.
- External input.
- Logging functions: Maximum temperatures, minimum temperatures, operating hours, operating cycles, power cycles, minutes above maximum temperature, minutes below minimum temperature, etc.

## References

### Product selection key


 CA12CA   BP  IO

 Enter the code option instead of 

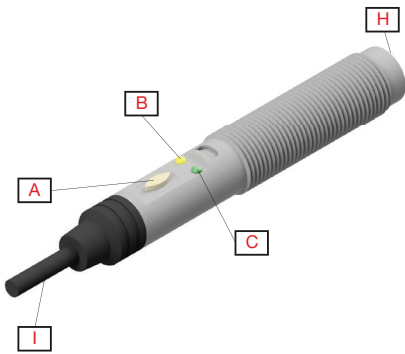
Code	Option	Description
C	-	Sensing principle: Capacitive sensor
A	-	Cylindrical housing with threaded barrel
12	-	Housing diameter (mm)
C	-	Plastic housing - PBT
A	-	Axial sensing
<input type="checkbox"/>	F	Flush installation
	N	Non-flush installation
<input type="checkbox"/>	04	Sensing distance: 4 mm (Flush)
	08	Sensing distance: 8 mm (Non-flush)
B	-	<b>Selectable functions:</b> NPN, PNP, Push-Pull, External Input (only pin 2) or External teach input (only pin 2)
P	-	<b>Selectable:</b> N.O. or N.C., each output
<input type="checkbox"/>	A2	2 metre PVC cable
	M1	M12, 4-pole connector
IO	-	IO-Link version

Additional characters can be used for customized versions.

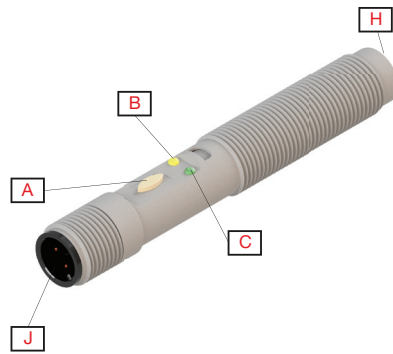
### Type selection

Connection	Distance	Mounting	Code
Cable	4 mm	Flush	CA12CAF04BPA2IO
	8 mm	Non-flush	CA12CAN08BPA2IO
Plug	4 mm	Flush	CA12CAF04BPM1IO
	8 mm	Non-flush	CA12CAN08BPM1IO

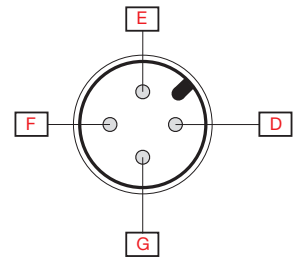
# Structure



**Fig. 1** CA12 Cable



**Fig. 2** CA12 Plug

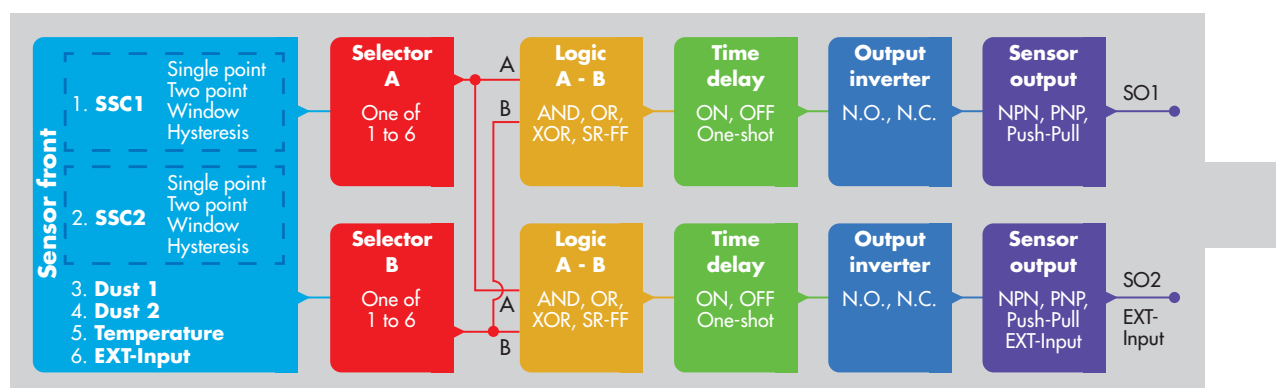


**Fig. 3** Colour code


<b>A</b>	Teach-button	<b>F</b>	Blue (Pin 3)
<b>B</b>	Yellow LED	<b>G</b>	Black (Pin 4)
<b>C</b>	Green LED	<b>H</b>	Sensing face
<b>D</b>	Brown (Pin 1)	<b>I</b>	2 m, 4 wire PVC Ø 3.3 mm cable
<b>E</b>	White (Pin 2)	<b>J</b>	M12x1, 4-pin male connector

# Sensing

## Detection



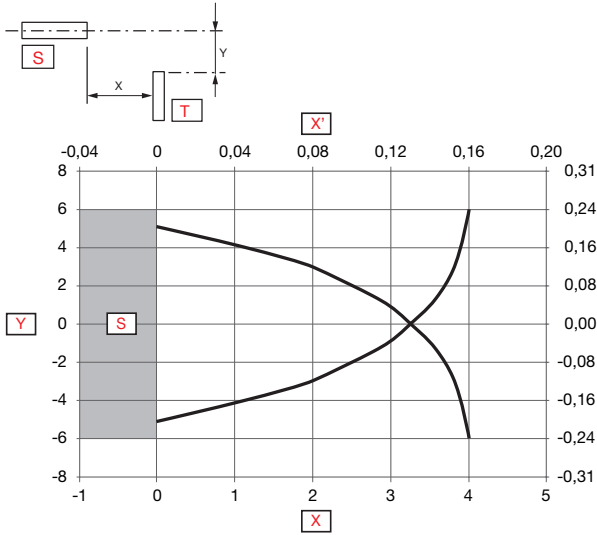
<b>Switching mode</b>	<b>SSC1</b> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• Single point mode</li> <li>• Two point mode</li> <li>• Windows mode</li> </ul> <b>Factory settings:</b> <i>Single point mode</i>	<b>SSC2</b> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• Single point mode</li> <li>• Two point mode</li> <li>• Windows mode</li> </ul> <b>Factory settings:</b> <i>Single point mode</i>
<b>Rated operating distance (S<sub>n</sub>)</b>	0 - 8 mm ( <b>Factory settings:</b> 8 mm), (ref. target 24x24 mm ST37, 1 mm thick, grounded)	Non-flush-mounted sensor
	0 - 4 mm ( <b>Factory settings:</b> 4 mm), (ref. target 12x12 mm ST37, 1 mm thick, grounded)	Flush-mounted sensor
<b>Sensitivity control (SSC1)</b>	Adjustable by Teach-button, external teach or by IO-Link settings <ul style="list-style-type: none"> <li>• Teach-button disabled</li> <li>• Teach-button enabled</li> <li>• Teach by wire</li> </ul> <b>Factory settings:</b> <i>Teach-button enabled</i>	
<b>Teach-button</b>	Used for teaching background or target	
<b>Adjustable distance</b>	0.5 ... 4 mm (Flush types) <b>Factory settings:</b> <i>SP1 1000 and SP2 10000</i>	
	0.5 ... 8 mm (Non-flush types) <b>Factory settings:</b> <i>SP1 1000 and SP2 10000</i>	
<b>Effective operating distance (S<sub>r</sub>)</b>	$0.9 \times S_n \leq S_r \leq 1.1 \times S_n$	
<b>Usable operating dist. (S<sub>u</sub>)</b>	$0.8 \times S_r \leq S_u \leq 1.2 \times S_r$	
<b>Hysteresis (H)</b> CA12CAF04... CA12CAN08...	Adjustable by IO-Link (1% to 100%) <b>Factory settings:</b> <i>Typical 4%</i> <b>Factory settings:</b> <i>Typical 6%</i>	
<b>Filter scaler</b>	This function can increase the immunity towards unstable targets and electromagnetic disturbances: Value can be set from 1 to 255. <b>Factory settings:</b> <i>1</i> (1 is max. operating frequency and 255 is min. operating frequency)	

 Alarm settings

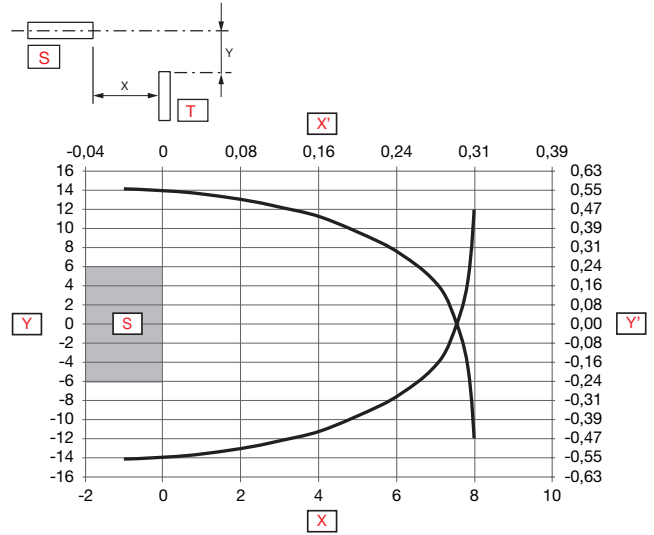
<b>Dust alarm SSC1 and SSC2</b> CA12CAF04... CA12CAN08...	0 to 100 % of actual SP <b>Factory settings:</b> Safe limits 8% <b>Factory settings:</b> Safe limits 12%
<b>Temperature alarm</b>	• High threshold -50 to +125°C • Low threshold -50 to +125°C <b>Factory settings:</b> High value 85°C (front temperature sensor used) Low value -30°C (front temperature sensor used)



**Detection diagram**



**Fig. 4 Flush**



**Fig. 5 Non-flush**

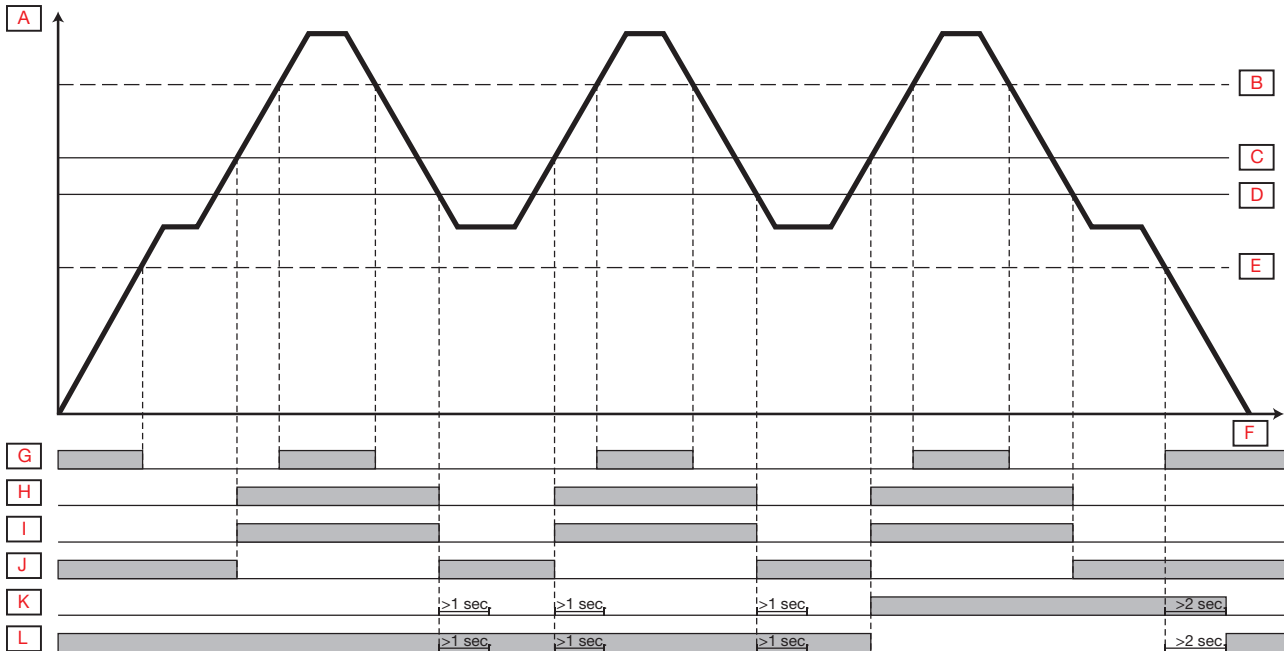
<b>Y</b>	Detection width [mm]	<b>X'</b>	Sensing range [inches]
<b>X</b>	Sensing range [mm]	<b>S</b>	Sensor
<b>Y'</b>	Detection width [inches]	<b>T</b>	Target

**Accuracy**

<b>Repeat accuracy (R)</b>	≤ 5%
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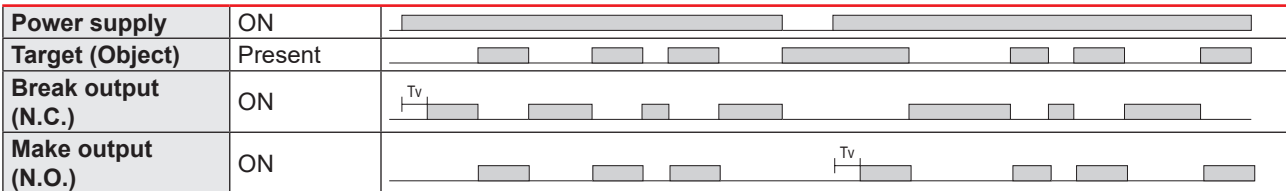
**Operation diagram**



<b>A</b>	Target influence	<b>G</b>	Green LED ON
<b>B</b>	stable ON	<b>H</b>	Yellow LED ON
<b>C</b>	Output ON	<b>I</b>	Output N.O.
<b>D</b>	Output OFF	<b>J</b>	Output N.C.
<b>E</b>	stable OFF	<b>K</b>	Dust alarm N.O.
<b>F</b>	Time	<b>L</b>	Dust alarm N.C.

**For default factory sensor**

T<sub>v</sub> = Power-ON delay



## Features

### Power Supply

Rated operational voltage ( $U_B$ )	10 ... 40 VDC (ripple included)
Ripple ( $U_{rpp}$ )	$\leq 10\%$
No load supply current ( $I_o$ )	$\leq 20$ mA
Rated insulation voltage ( $U_i$ )	50 VDC
Power-ON delay (tv)	$\leq 300$ ms

### Input selector

Input selector	<b>Channel A</b> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• SSC1</li> <li>• SSC2</li> <li>• Dust alarm 1</li> <li>• Dust alarm 2</li> <li>• Temperature alarm</li> <li>• External logic input</li> </ul> <b>Factory settings: SSC1</b>	<b>Channel B</b> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• SSC1</li> <li>• SSC2</li> <li>• Dust alarm 1</li> <li>• Dust alarm 2</li> <li>• Temperature alarm</li> <li>• External logic input</li> </ul> <b>Factory settings: SSC1</b>
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### Logic functions

Logic functions	<b>Channel A + B for SO1</b> <ul style="list-style-type: none"> <li>• Direct</li> <li>• AND</li> <li>• OR</li> <li>• X-OR</li> <li>• SR-FF (Set-Reset Flip-Flop)</li> </ul> <b>Factory settings: Direct</b>	<b>Channel A + B for SO2</b> <ul style="list-style-type: none"> <li>• Direct</li> <li>• AND</li> <li>• OR</li> <li>• X-OR</li> <li>• SR-FF (Set-Reset Flip-Flop)</li> </ul> <b>Factory settings: Direct</b>
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### Time delays

Timer mode	<b>For SO1</b> <ul style="list-style-type: none"> <li>• Disabled</li> <li>• ON delay</li> <li>• OFF delay</li> <li>• ON delay and OFF delay</li> <li>• One-shot leading edge</li> <li>• One-shot trailing edge</li> </ul> <b>Factory settings: Disabled</b>	<b>For SO2</b> <ul style="list-style-type: none"> <li>• Disabled</li> <li>• ON delay</li> <li>• OFF delay</li> <li>• ON delay and OFF delay</li> <li>• One-shot leading edge</li> <li>• One-shot trailing edge</li> </ul> <b>Factory settings: Disabled</b>
Timer scale	<b>For SO1</b> <ul style="list-style-type: none"> <li>• Milliseconds [ms]</li> <li>• Seconds [s]</li> <li>• Minutes [min]</li> </ul> <b>Factory settings: ms</b>	<b>For SO2</b> <ul style="list-style-type: none"> <li>• Milliseconds [ms]</li> <li>• Seconds [s]</li> <li>• Minutes [min]</li> </ul> <b>Factory settings: ms</b>
Timer value	<b>For SO1</b> <ul style="list-style-type: none"> <li>• 0 ... 32 767</li> </ul> <b>Factory settings: 0</b>	<b>For SO2</b> <ul style="list-style-type: none"> <li>• 0 ... 32 767</li> </ul> <b>Factory settings: 0</b>

### Output Inverter

Output Inverter	<b>For SO1 Pin 4 Black wire:</b> <ul style="list-style-type: none"> <li>• Not inverted [N.O.]</li> <li>• Inverted [N.C.]</li> </ul> <b>Factory settings: N.O.</b>	<b>For SO2 Pin 2 White wire:</b> <ul style="list-style-type: none"> <li>• Not inverted [N.O.]</li> <li>• Inverted [N.C.]</li> </ul> <b>Factory settings: N.C.</b>
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### Sensor Output

Switching Output Stage SO1 and SO2	<b>For SO1 Pin 4 Black wire:</b> <ul style="list-style-type: none"> <li>• Disabled output</li> <li>• PNP</li> <li>• NPN</li> <li>• Push-Pull</li> </ul> <b>Factory settings: PNP</b>	<b>For SO2 Pin 2 White wire:</b> <ul style="list-style-type: none"> <li>• Disabled output</li> <li>• PNP</li> <li>• NPN</li> <li>• Push-Pull</li> <li>• External input, active high</li> <li>• External input, active low</li> <li>• Teach-in</li> </ul> <b>Factory settings: PNP</b>
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### Outputs

Rated operational current ( $I_o$ )	$\leq 200$ mA (Continuous, SO1 + SO2)	
OFF-state current ( $I_o$ )	$\leq 100$ $\mu$ A	
Minimum operational current ( $I_m$ )	$> 0,5$ mA	
Voltage drop ( $U_d$ )	$\leq 1.0$ VDC @ 200 mA DC	
Protection	Short circuit, reverse polarity, transients	
Utilization category	DC-12	Control of resistive loads and solid-state loads with optical isolation
	DC-13	Control of electromagnets
Load capacitance max at ( $U_o$ )	100 nF	

### Response times

<b>Standard mode</b>		
Operating frequency (f)	15 Hz.	
Response times	CA12CA...	$t_{ON}$ (OFF-ON): $< 26$ ms
		$t_{OFF}$ (ON-OFF): $< 37$ ms
<b>High-speed mode</b>		
Operating frequency (f)	50 Hz.	
Response times	CA12CAF04...	$t_{ON}$ (OFF-ON): $< 10$ ms
		$t_{OFF}$ (ON-OFF): $< 10$ ms
	CA12CAN08...	$t_{ON}$ (OFF-ON): $< 9$ ms
		$t_{OFF}$ (ON-OFF): $< 11$ ms

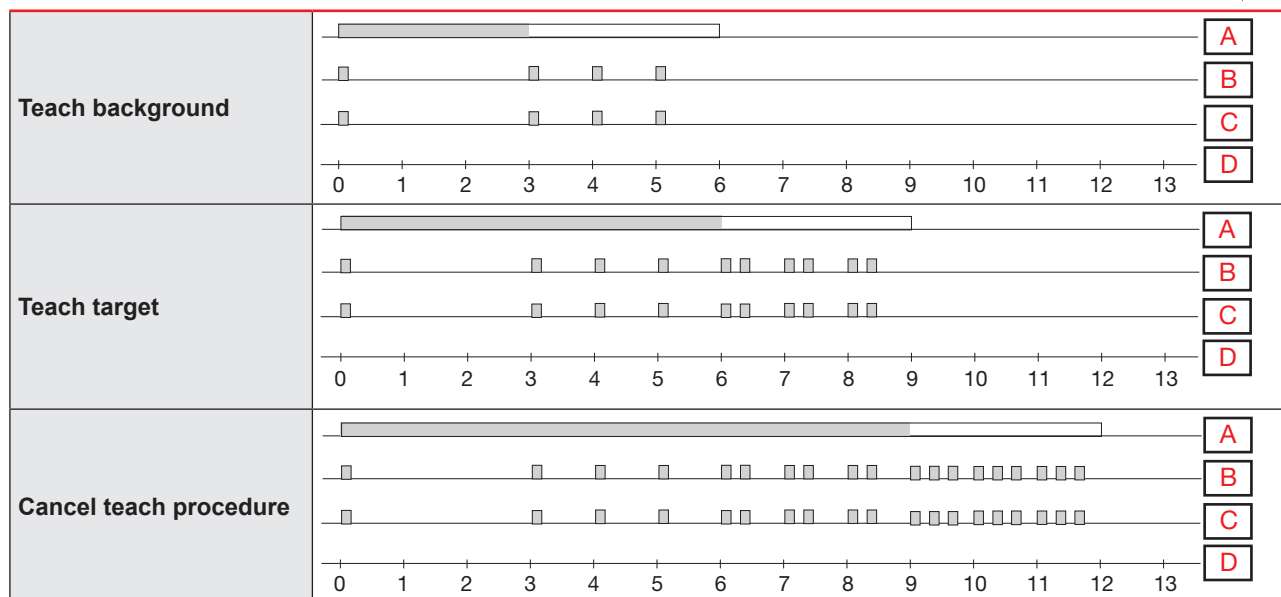

**Indication**

Green LED	Yellow LED	Power	Function
<b>In SIO and IO-Link mode</b>			
ON	ON	ON	ON (stable)* SSC1
ON	OFF	ON	OFF (stable)* SSC1
OFF	ON	ON	ON (Not stable) SSC1
OFF	OFF	-	OFF (Not stable) SSC1
-	Flashing 10Hz 50% dutycycle	ON	Output short-circuit
-	Flashing (0.5...20Hz)	ON	Timer indication
<b>In SIO mode only</b>			
<b>All teach procedures are starting with a flash ON 100 ms OFF until teach-window start</b>			
Flashing 1 short pulse simultaneously on both LED's		ON	External teach by wire. Only for single point mode
Flashing 1 short pulse per sec simultaneously on both LED's		ON	Teach background (3 - 6 sec)
Flashing 2 short pulses per sec simultaneously on both LED's		ON	Teach target (6 - 9 sec)
Flashing 3 short pulses per sec simultaneously on both LED's		ON	Cancel teach procedure (> 9 sec)
Flashing 4 times simultaneously, 50% dutycycle		ON	Teach successful
<b>In IO-Link mode only</b>			
Flashing 1 HZ <b>In stable mode:</b> ON 900 ms OFF 100 ms <b>In non stable mode:</b> ON 100 ms OFF 900 ms	-	ON	Sensor is in IO-Link mode
Flashing 2 Hz alternating 50% dutycycle		ON	Find my sensor

\*See operation diagram


**LED indication**

<b>IO-Link LED indication modes</b>	<ul style="list-style-type: none"> <li>• LED Indication disabled</li> <li>• LED Indication enabled</li> <li>• Find my sensor</li> </ul> <p><b>Factory settings:</b> LED Indication enabled</p>
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<b>A</b>	Teach-button	<b>D</b>	Time (sec)
<b>B</b>	Green LED	■	Active
<b>C</b>	Yellow LED		

**Environmental**

<b>Ambient temperature</b>	-30°C... +85°C (-22°F... +185°F)	Operating
	-40°C ... +85°C (-40°F ... +185°F)	Storage
<b>Ambient humidity range</b>	35% ... 95%	Operating
	35% ... 95%	Storage
<b>Vibration</b>	10 ... 150 Hz, 1 mm / 15 G	EN 60068-2-6
<b>Shock</b>	30 G / 11 ms, 3 pos, 3 neg per axis	EN 60068-2-27
<b>Drop test</b>	2 x 1 m 100 x 0.5 m	EN 60068-2-31
<b>Rated insulation voltage</b>	50VDC	
<b>Rated impulse withstand voltage</b>	> 2kV (with 500 Ω)	
<b>Overvoltage category</b>	III	IEC 60664, EN 60947-1
<b>Pollution degree</b>	3	IEC 60664, 60664A; EN 60947-1
<b>IP rating</b>	IP 67, IP 68/60 min.,	EN 60529, EN 60947-1
<b>NEMA Enclosure Types</b>	1, 2, 12	NEMA 250
<b>Tightening torque</b>	≤ 1.8 Nm	
<b>Dielectric insulation voltage</b>	1kVAC rms (50/60 Hz for 1 min.)	


**TRIPLESIELD™**

Exceeding the norms for capacitive sensors.


<b>Electrostatic discharge immunity test</b>	contact discharge	> 30 kV	IEC 61000-4-2; EN60947-1
	air discharge	> 30 kV	
<b>Electromagnetic field immunity</b>	15 V/m		IEC 61000-4-3; EN60947-1
<b>Electrical fast transient immunity</b>	±4kV / 5kHz		IEC 61000-4-4; EN60947-1
<b>Wire-conducted noise</b>	> 10 Vrms		IEC 61000-4-6; EN60947-1
<b>Power frequency magnetic fields</b>	Continuous	> 60 A/m, 75.9 μ tesla	IEC 61000-4-8; EN60947-1
	Short-time	> 600 A/m, 759 μ tesla	


**Diagnostic parameters**

Function	Unit	Range
<b>Values stored in the sensor (Saved every hour)</b>		
<b>Operating Hours</b>	[h]	0 ... 2 147 483 647
<b>Number of Power Cycles</b>	[cycles]	0 ... 2 147 483 647
<b>Maximum temperature - All time high</b>	[°C]	-50 ... +150
<b>Minimum temperature - All time low</b>	[°C]	-50 ... +150
<b>Detection counter SSC1</b>	[cycles]	0 ... 2 147 483 647
<b>Minutes above Maximum Temperature</b>	[min]	0 ... 2 147 483 647
<b>Minutes below Minimum Temperature</b>	[min]	0 ... 2 147 483 647
<b>Values stored in the sensor (Saved with events)</b>		
<b>Error Count</b>	[counts]	0 ... 2 147 483 647
<b>Download counter</b>	[counts]	0 ... 65 536
<b>Quality of Teach</b>	[%]	0 ... 250%
<b>Values not saved in sensor</b>		
<b>Maximum temperature - Since last power-up</b>	[°C]	-50 ... +150
<b>Minimum temperature - Since last power-up</b>	[°C]	-50 ... +150
<b>Current temperature</b>	[°C]	-50 ... +150
<b>Quality of Run</b>	[%]	0 ... 250%


**Events Configuration**

Events	Factory default setting
<b>Maintenance</b>	Inactive
<b>Temperature fault event</b>	Inactive
<b>Temperature over-run</b>	Inactive
<b>Temperature under-run</b>	Inactive
<b>Short circuit</b>	Inactive


**Process data configuration**

Process Data	Factory default setting
Analogue value	Active
SC, Short circuit	Inactive
TA, Temperature alarm	Inactive
DA2, Dust alarm for SSC2	Inactive
DA1, Dust Alarm for SSC1	Inactive
SSC2, Sensor switching channel 2	Inactive
SSC1, Sensor switching channel 1	Inactive
SO2, Switching output 2	Active
SO1, Switching output 1	Active

## Process data structure

4 Bytes, Analogue value 16 ... 31 (16 bit)

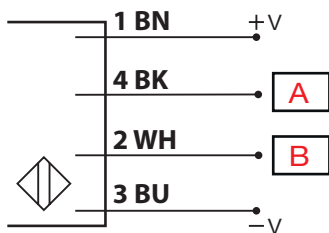
Byte 0	31	30	29	28	27	26	25	24
	<b>MSB</b>	-	-	-	-	-	-	-
Byte 1	23	22	21	20	19	18	17	16
	-	-	-	-	-	-	-	<b>LSB</b>
Byte 2	15	14	13	12	11	10	9	8
	-	-	<b>SC</b>	<b>TA</b>	<b>DA2</b>	<b>DA1</b>	<b>SSC2</b>	<b>SSC1</b>
Byte 3	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	<b>SO2</b>	<b>SO1</b>

## Mechanics/electronics

### Connection

<b>Cable</b>	2 m, 4 wire, 4 x 0,14 mm <sup>2</sup> , Ø3.3 mm Oil proof PVC, black
<b>Plug (M1)</b>	M12 x 1, 4 pin male

### Wiring

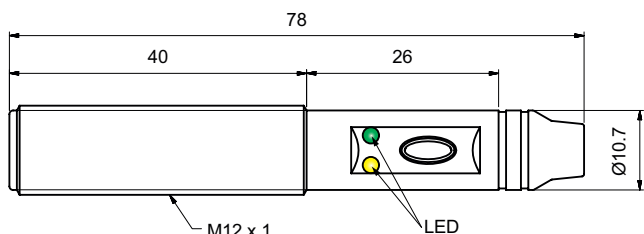


BN	BK	WH	BU	A	B
Brown	Black	White	Blue	OUT/IO-Link	IN/OUT

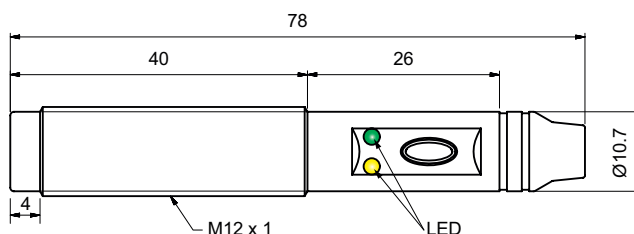
### Housing

<b>Body front</b>	PBT Grey, 30% glass-reinforced	
<b>Body back</b>	PBT Grey	
<b>Teach-button</b>	TPE	
<b>Light guides</b>	TPE	
<b>Cable gland</b>	Polyester, softened	
<b>Finger nuts</b>	PBT Black, 30% glass-reinforced	
<b>Dimensions</b>	M12 x 1	Thread
<b>Thread length</b>	36 mm	Non-flush
	40 mm	Flush
<b>Total length</b>	78 mm	Cable version
	80 mm	Plug version
<b>Weight</b>	30 g	Cable version
	20 g	Plug version

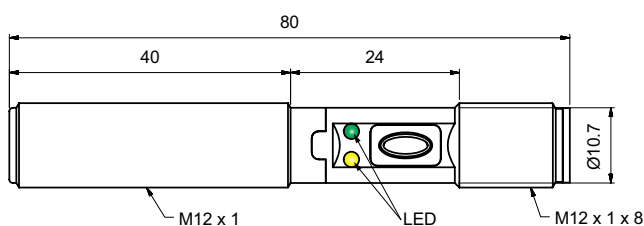
**Dimensions (mm)**



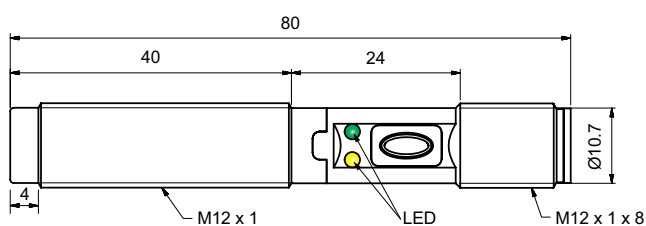
**Fig. 6 Cable CA12CAF...A2IO**



**Fig. 7 Cable CA12CAN...A2IO**





**Fig. 8 Plug CA12CAF...M1IO**



**Fig. 9 Plug CA12CAN...M1IO**

## Compatibility and conformity

### Approvals and markings

<b>General reference</b>	Sensor designed according to EN60947-5-2 and EN60947-1	
<b>MTTF<sub>d</sub></b>	161.1 years @ 40°C (+104°F)	ISO 13849-1, SN 29500
<b>CE-marking</b>		
<b>Approvals</b>	 (UL508)	

### IO-Link

<b>IO-Link revision</b>	1.1
<b>Transmission rate</b>	COM2 (38.4 kbaud)
<b>SDCI-Norm</b>	IEC 61131-9
<b>Profile</b>	Smart sensor profile 2nd edition, common profile
<b>Min. cycle time</b>	5 ms
<b>SIO mode</b>	Yes
<b>Min. master port class</b>	A (4-pin)
<b>Process data length</b>	32 bit



## Delivery contents and accessories




### Delivery contents

Capacitive sensor: CA12CAxxBPxxIO  
 2 x M12 finger nuts  
 Packaging: Carton box

### Accessories

Connector type CON.14NF-... -series.  
 Mounting Brackets AMB12-S.. (straight), AMB12-A.. (angled)

### Further information

Information	Where to find it	QR
IO-Link manual	<a href="http://cga.pub/?010b41">http://cga.pub/?010b41</a>	
Mounting brackets	<a href="http://cga.pub/?68adbc">http://cga.pub/?68adbc</a>	
Connectors	<a href="http://cga.pub/?ed457b">http://cga.pub/?ed457b</a>	



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